معادلات حاکم بر دینامیک سیالات

- ❑ معادله پایستاری جرم
- ❑ معادله ممنتوم
- ❑ اصل بقای انرژی
- ❑ معادله حالت

معادلات حاکم بر دینامیک سیالات

Continuity	$\dfrac{\partial \rho}{\partial t} + \operatorname{div}(\rho \mathbf{u}) = 0$
x-momentum	$\dfrac{\partial(\rho u)}{\partial t} + \operatorname{div}(\rho u \mathbf{u}) = -\dfrac{\partial p}{\partial x} + \operatorname{div}(\mu \operatorname{grad} u) + S_{Mx}$
y-momentum	$\dfrac{\partial(\rho v)}{\partial t} + \operatorname{div}(\rho v \mathbf{u}) = -\dfrac{\partial p}{\partial y} + \operatorname{div}(\mu \operatorname{grad} v) + S_{My}$
z-momentum	$\dfrac{\partial(\rho w)}{\partial t} + \operatorname{div}(\rho w \mathbf{u}) = -\dfrac{\partial p}{\partial z} + \operatorname{div}(\mu \operatorname{grad} w) + S_{Mz}$
Energy	$\dfrac{\partial(\rho i)}{\partial t} + \operatorname{div}(\rho i \mathbf{u}) = -p \operatorname{div} \mathbf{u} + \operatorname{div}(k \operatorname{grad} T) + \Phi + S_i$
Equations of state	$p = p(\rho, T)$ and $i = i(\rho, T)$
	e.g. perfect gas $p = \rho R T$ and $i = C_v T$

$$\boxed{\frac{\partial(\rho\phi)}{\partial t} + \operatorname{div}(\rho \phi \mathbf{u}) = \operatorname{div}(\Gamma \operatorname{grad} \phi) + S_\phi}$$

Transport Equation معادله انتقال براي خاصيت φ

$$\frac{\partial(\rho\phi)}{\partial t} + \operatorname{div}(\rho\phi\mathbf{u}) = \operatorname{div}(\Gamma \operatorname{grad} \phi) + S_\phi$$

Rate of increase of ϕ of fluid element	+	Net rate of flow of ϕ out of fluid element	=	Rate of increase of ϕ due to diffusion	+	Rate of increase of ϕ due to sources

حالت‌هاي مختلف

- ❑ معادله انتقال در حالت کلی

$$\frac{\partial(\rho\phi)}{\partial t} + \operatorname{div}(\rho\phi\mathbf{u}) = \operatorname{div}(\Gamma \operatorname{grad} \phi) + S_\phi$$

- ❑ جریان پایا

$$\operatorname{div}(\rho\phi\mathbf{u}) = \operatorname{div}(\Gamma \operatorname{grad} \phi) + S_\phi$$

- ❑ مسائل نفوذ

$$\operatorname{div}(\Gamma \operatorname{grad} \phi) + S_\phi = 0$$

- ❑ مسائل نفوذ- جابجایی

$$\operatorname{div}(\rho\mathbf{u}\phi) = \operatorname{div}(\Gamma \operatorname{grad} \phi) + S_\phi$$